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US 5410815 A

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UK CL (Edition O) F3C CTA

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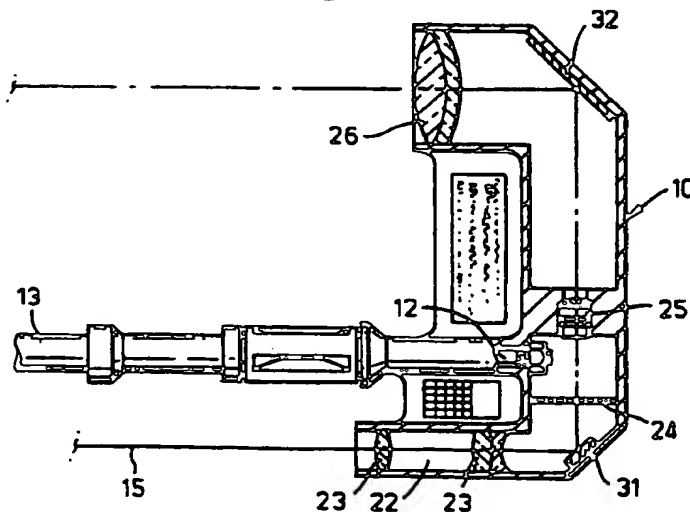
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(54) Weapon designator alignment apparatus

(57) The present invention relates to a weapon designator alignment apparatus particularly for use in aligning a weapon barrel with a laser designator unit. Apparatus is described comprising means 12 adapted to locate in or on the barrel of the weapon, and a housing 10 in fixed spatial relationship with the locating means, the housing comprising means to direct a beam of light incident thereupon onto an indicator 25 positioned within the housing such that when the beam is directed towards the same point in space as the barrel of the weapon at a predetermined range, the beam illuminates the indicator. Typically, the locating means comprises a spigot adapted to be received in the bore of the weapon. The indicator preferably comprises a graticule or reticule. The apparatus is typically adapted for use with a laser designator emitting infra-red light.

Fig.2.



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Fig.3.

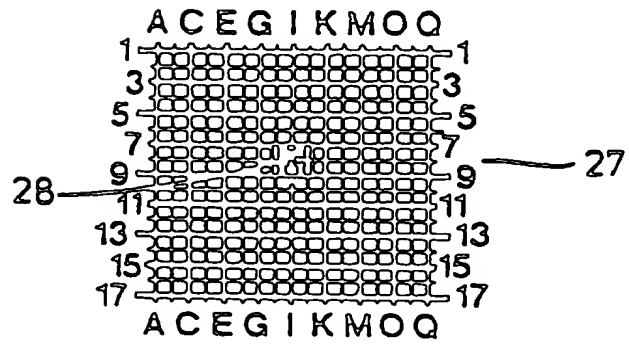


Fig.4.

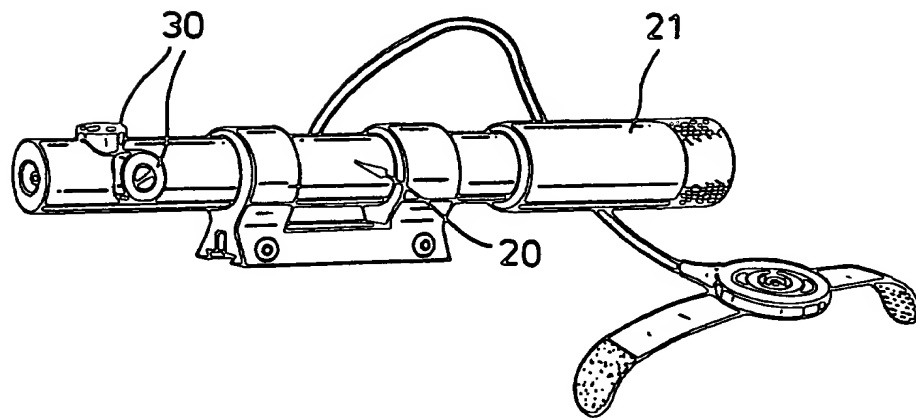
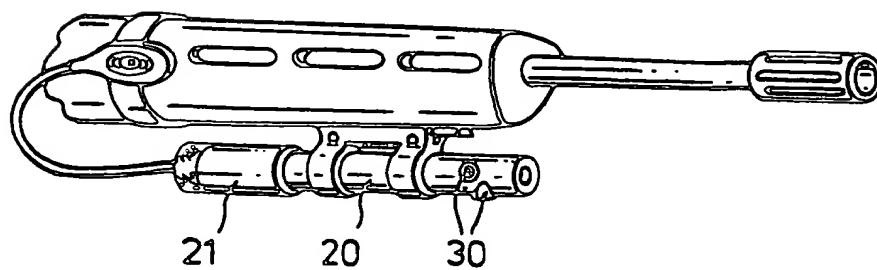


Fig.5.



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Fig.6.

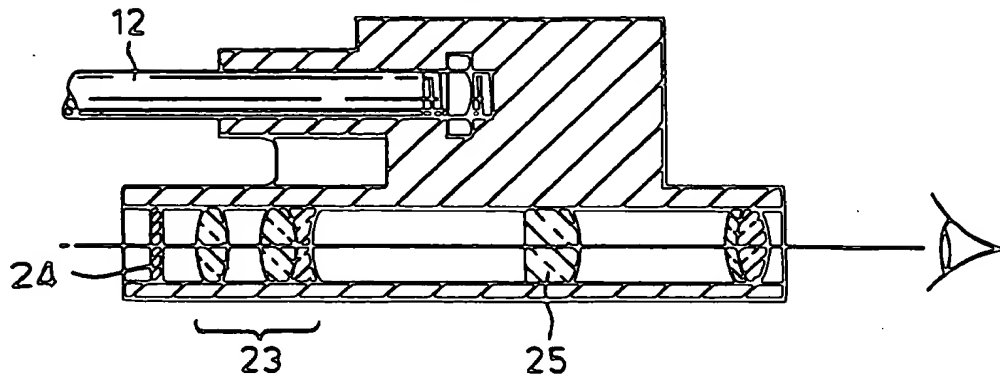


Fig.7.

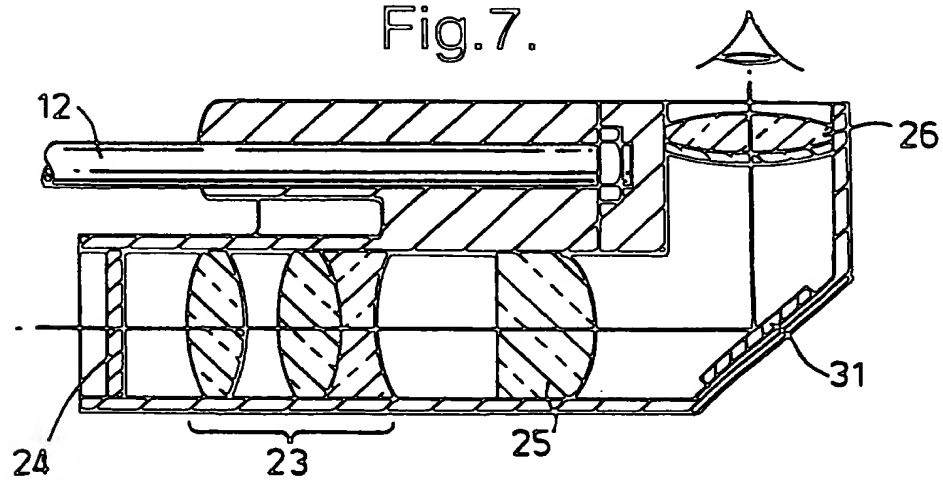


Fig.8.

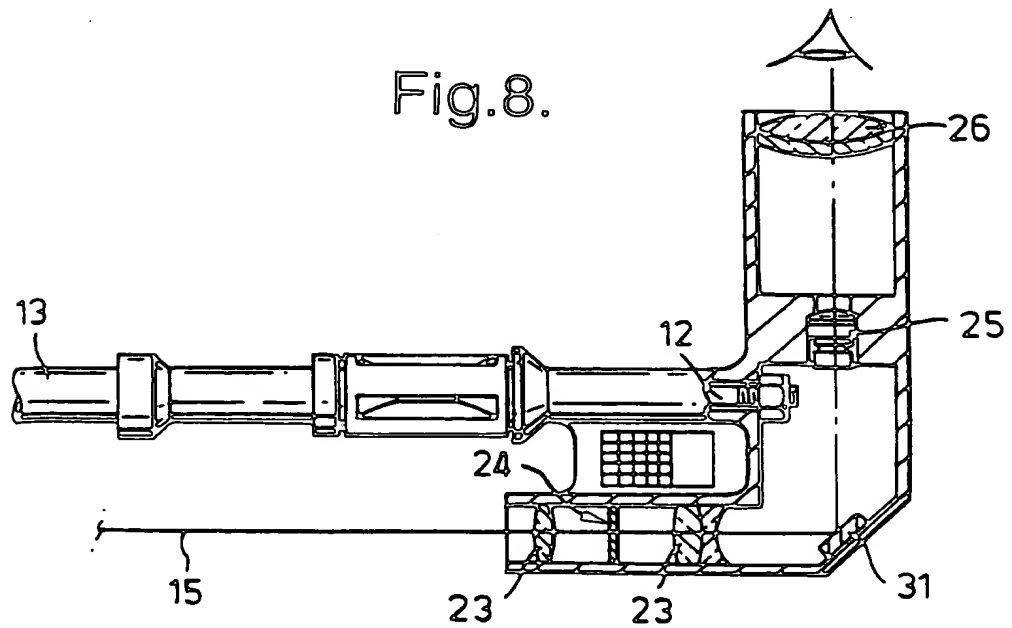


Fig.9.

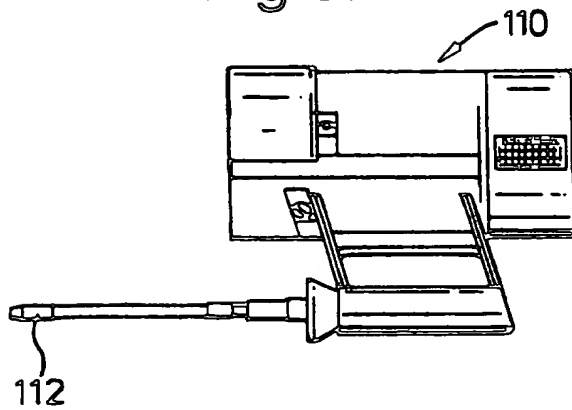


Fig.10.

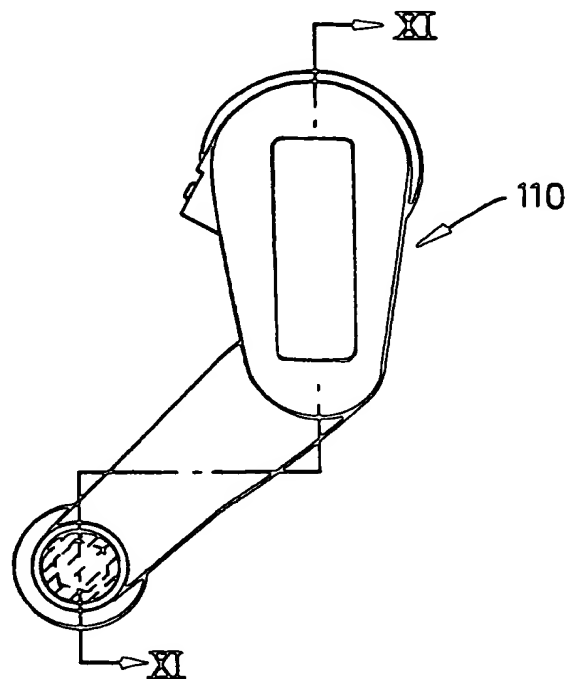
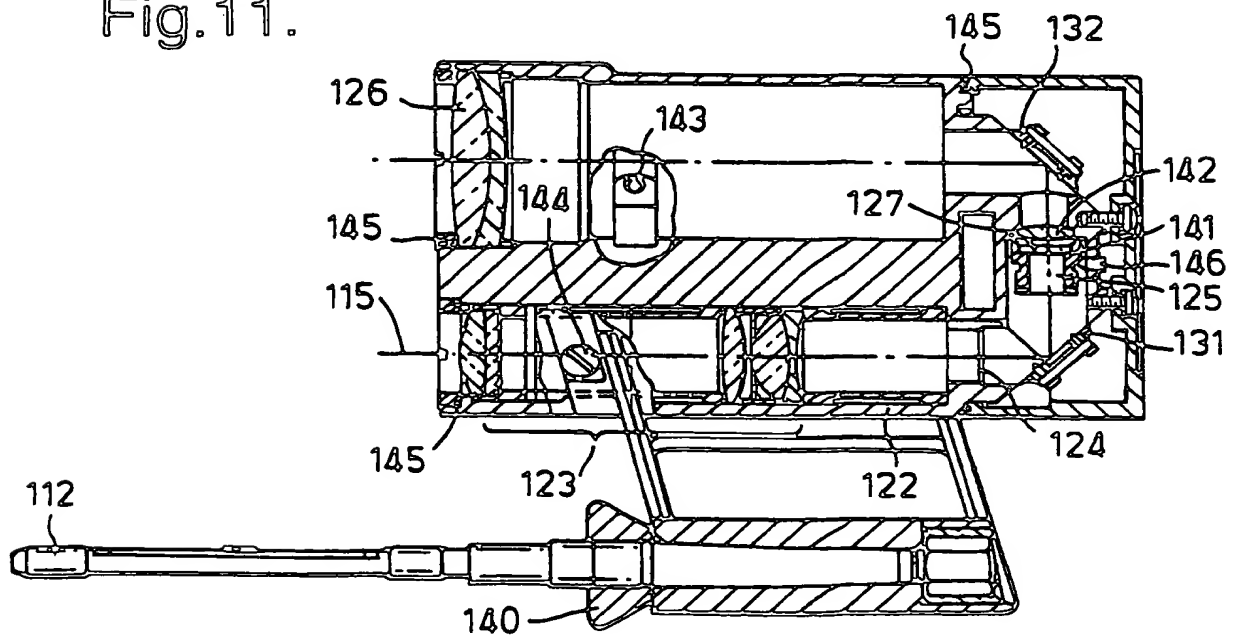


Fig.11.



WEAPON DESIGNATOR ALIGNMENT APPARATUS

The present invention relates to a weapon designator alignment apparatus particularly for use in aligning a weapon barrel with a laser designator unit.

5 When weapons are deployed in operational situations, including covert or peace-keeping rôles, correct zeroing of the sight with the barrel of the weapon is essential. The need for accuracy is compounded by the use of optical and night vision sights which are more sensitive to rough handling than so-called iron sights and therefore require more frequent checking and resetting. Conventionally, this is carried out in small arms by boresighting and firing live ammunition at a fixed target and adjusting
10 the sight until the sight is aligned to the same point to which the firearm fires. This procedure is clearly effective, but is rather time consuming and expensive in terms of ammunition used and the provision of range facilities. This procedure is not always appropriate or possible, particularly during peace-keeping rôles and is doubly difficult in night-time conditions.

15 Apparatus for overcoming the problem of firing live ammunition to zero a weapon sight has been proposed. The apparatus includes a collimator incorporating a graticule attached to, and in alignment with, a spigot and displaced apart therefrom by means of a brace. The spigot is received in the bore of the weapon. The collimator is viewed through the weapon sight and the sight adjusted until the sight
20 is appropriately aligned with the graticule pattern. The spigot is designed for a particular weapon, so providing an accurate and reproducible datum contact with the weapon's bore. The centre axes of the spigot and collimator are set for a particular weapon/sight combination and are not adjustable in the field, thus ensuring reliability and accuracy.

25 In recent years there has been an increase in the development and use of infra-red laser illuminators, which are frequently called pointers or designators, to pin-point

a target. The laser is attached to the firearm and aligned with its barrel and directs a point of light towards the target. The soldier uses an image intensifying viewer so that he can 'see' the beam of infra red light reflected back off the target and thus determine when to pull the trigger.

5 In such an arrangement, the soldier is not necessarily looking along the barrel of the gun when the trigger is pulled. The soldier relies entirely on the laser and image intensifier to determine when the target is in sight. Accordingly, there is a very great need to ensure that the laser is accurately aligned with the gun barrel. Adjustment is made, as before, by firing live ammunition, or by aligning a night
10 vision sight with a conventional collimator as described above and then adjusting the laser to the night vision sight's aiming mark on a selected object at an already known range. Alignment of the laser with the barrel therefore requires two adjustments to be made and an appropriate range to be determined in darkened conditions. Alternatively, a collimator incorporating a built-in image intensifier is used.
15 Accordingly, the procedure is somewhat time consuming. There is therefore a need for a device that will enable rapid and economical but accurate alignment and which can be used in the field in any light and conditions.

The present invention provides an apparatus adapted for use in aligning a weapon designator emitting a beam of light with the bore of a respective weapon; the
20 apparatus comprising means adapted to locate in or on the barrel of the weapon, and a housing in fixed spatial relationship with the locating means, the housing comprising means to direct a beam of light thereupon onto an indicator positioned within the housing such that when the beam is directed towards the same point in space as the barrel of the weapon at a predetermined range, the beam illuminates the
25 indicator.

Typically, the locating means comprises a spigot adapted to be received in the bore of the weapon.

Conveniently, the indicator will comprise a graticule or reticule.

By referring to 'light' it will be understood that the term is intended to also encompass radiation of wavelengths other than in the visible region of the spectrum, in particular infra-red and ultra-violet. In practice, the designator will most often be
5 a laser designator, typically, emitting in the infra-red region, and the apparatus will accordingly be adapted for use with such a laser.

The above and other aspects of the present invention will now be illustrated, by way of example only, with reference to the accompanying drawings in which:

- 10 Figure 1 show in side view a first embodiment of an apparatus in accordance with the present invention in position on the barrel of a rifle;
- Figure 2 shows in cross-section the embodiment of Figure 1 on the barrel of a rifle;
- Figure 3 illustrates a form of graticule suitable for inclusion in an embodiment of the device of the present invention;
- 15 Figure 4 shows a conventional laser designator unit;
- Figure 5 shows the laser designator unit of Figure 4 in place on the barrel of a rifle;

Figures 6 to 8 each illustrates schematically an alternative arrangement of an apparatus in accordance with the present invention;

- 20 Figure 9 shows a side view of a second embodiment of an apparatus in accordance with the present invention;

Figure 10 shows an end view of the embodiment of Figure 9; and

Figure 11 shows in cross section along the line XI-XI of Figure 10.

Referring to Figures 1 and 2, an apparatus in accordance with the present invention for use in aligning a laser designator of a weapon is shown generally at 10 and comprises a housing which locates in a rifle 11 by means of a spigot 12 which engages accurately in the bore of the rifle barrel 13.

The rifle 11 is fitted with a laser designator 14 which is user adjusted by a conventional method to direct the laser beam 15 towards the same point to which the rifle fires, taking into account the range of the rifle and ballistic drop - the vertical amount by which a projectile falls over distance. The laser is typically a Class 1 (eye-safe) laser producing a beam in the wavelength range 800-820 nm (infra-red) with an output power of about 0.01mW or less. In the embodiment shown in Figures 1 and 2, the laser is built into the hand-guard of the rifle 11 on the underside of the barrel 13, thus not interfering with the conventional sights on the rifle. In the alternative embodiment of Figures 4 and 5, the laser designator unit 20 with appendant battery pack 21 is mounted on the upper surface of the rifle handguard. Figures 1, 4 and 5 also illustrate that the trajectory of a conventional laser designator unit may be adjusted in two planes by means of adjustment knobs 30

The embodiment of the apparatus of the present invention shown includes a tube 22 arranged in fixed spatial relationship with respect to the spigot and thus, in use, aligned with the bore of the rifle, such that when the device is correctly inserted into the bore of the rifle, the beam 15 from the laser enters the tube. Clearly, the exact separation of the entrance tube 22 from the spigot 12 and the alignment of the tube 22 and spigot 12 will depend upon the particular combination of rifle and laser device. The suitable arrangement for a particular combination will be readily determined.

- Entrance tube 22 includes condensing lenses 23 to focus the laser light beam as appropriate and a filter/diffuser element 24, typically an opal glass plate. The laser beam then passes through an indicator in the form of a graticule or reticle assembly 25 of generally conventional construction. Typically, the graticule or reticle comprises a pattern 27 printed or etched onto a glass plate, with a ground glass rear surface to aid definition. An example graticule pattern is shown in Figure 3 and presents a grid format to allow for an alpha-numeric co-ordinate reference. The user knows that the laser is correctly aligned with the direction of fire when the laser beam coincides with the centre mark 28 on the graticule pattern 27 when viewed through eye-piece 26. Using the same device, conventional and night sights can also be set. The filter/diffuser element 24 provides back-lighting for the graticule and cuts the laser spot power to eye-safe levels. The filter/diffuser element 24 may essentially be positioned anywhere in the entrance tube 22 before the graticule or reticle assembly 25.
- The positioning of the graticule assembly 25 is set during manufacture of the laser designator alignment apparatus for a particular weapon/laser designator combination, taking into account the positioning of the laser with respect to the barrel of the weapon. Thus, the user in the field cannot adjust the apparatus and knows reliably that once the laser designator is adjusted, the laser beam is accurately aligned.
- As illustrated in Figures 1 and 2, the housing of the apparatus 10 has a generally offset W shape. Mirrors 31,32 deflect the incoming light beam into the path of the graticule and into the eye-piece 26 which, as shown, directs the beam to a user. Alternative arrangements are clearly possible without affecting the operation of the device. For example, the graticule 25 and eye-piece 26 could be directly in-line with the entrance tube 22 (Figure 6), although in practice this arrangement would not be preferred as it would involve the user looking down the barrel of the gun and towards the laser in order to view the graticule. One suitable alternative would be to view the graticule from above without the use of the second mirror 32 (Figures

7 and 8). Such matters concern only the practical implementation of the optical arrangement of the invention and variations will be apparent to those skilled in the art. The eye device in Figures 1 and 6 to 8 is intended to indicate the direction from which the indicator is viewed. Where the designator does not emit light in the visible region, additional apparatus will be required, such as an image intensifying monocular or additional equipment within the apparatus itself to provide a visible image. Both now and in the future, designators emitting light across the electromagnetic spectrum may be available. The apparatus of the present invention will be adapted accordingly.

10 An alternative embodiment is shown in Figures 9 to 11. This embodiment, shown generally at 110, locates in the barrel of a rifle (not shown) by means of a spigot 112. A bumper 140 protects the exit end of the barrel from damage when inserting and removing the apparatus. The apparatus 110 is generally the same as described above, but is adapted for use with a laser designator mounted above the rifle barrel and to one side. A laser beam 115 enters the apparatus 110 through an entrance tube 122, passing through condensing lenses 123, a filter/diffuser element 124 and graticule or reticle assembly 125, before emerging through an eye-piece 126. Opposing mirrors 131 and 132 are provided to reflect the laser light beam back to the user.

20 Graticule or reticle assembly 125 is shown comprising a reticle 127 in a housing 141 and a field lens 142 to focus the graticule image onto lens 132, the assembly being held in place with adjustment screws 146.

Valves 143 and 144 are provided in the apparatus 110 housing so that the apparatus may be evacuated or the atmosphere purged with an inert gas, typically nitrogen. Accordingly, O-ring seals and gaskets 145 are provided as necessary upon assembly of the apparatus.

As indicated above, throughout this description of the invention, references to the correct alignment of barrel and designator take into account the intended range of the weapon and ballistic drop over that range.

5 Many alternative arrangements will be readily apparent. For example, the apparatus could be adapted to clamp onto the outside of the weapon barrel rather than locate in the bore of the barrel. The principal consideration is that the apparatus is adapted to locate on or in the barrel such that in use the apparatus can be simply attached to the weapon and the user knows that it will be accurately positioned. As indicated above, the spatial arrangement of the weapon-barrel locating means is fixed for a
10 particular weapon/designator configuration. This is not to say that the spatial arrangement is not adjustable. Clearly the arrangement is preferably not capable of adjustment in the field, but the apparatus may be adjustable to suit a different combination prior to issue to a soldier. In particular, it may be necessary to set the designator to different ranges under different operational conditions. Thus the
15 apparatus of the present invention may be adjustable by provision of an alternative indicator assembly, or a number of different apparatus may be provided to match the required range of weapon ranges.

Similarly, alternative means of viewing the alignment of the beam in the apparatus housing will be apparent. For example, an optical arrangement which provides a
20 viewing screen which remains unilluminated when the designator is incorrectly aligned but becomes instantaneously brightly lit when the designator beam is correctly aligned. Alternatively, the arrangement may provide a wide circular beam of light which fills a viewing screen only when the designator beam is correctly aligned, otherwise the beam of light is offset from the centre of the viewing screen.
25 As with the use of a graticule, such an arrangement has the advantage of providing an indication of the direction in which the designator needs to be adjusted to attain correct alignment.

Claims

1. Apparatus adapted for use in aligning a weapon designator emitting a beam of light with the bore of a respective weapon; the apparatus comprising means adapted to locate in or on the barrel of the weapon, and a housing in fixed spatial relationship with the locating means, the housing comprising means to direct a beam of light thereupon onto an indicator positioned within the housing such that when the beam is directed towards the same point in space as the barrel of the weapon at a predetermined range, the beam illuminates the indicator.
2. Apparatus as claimed in Claim 1 wherein the locating means comprises a spigot adapted to be received in the bore of the weapon.
3. Apparatus as claimed in Claim 1 or Claim 2 wherein the indicator comprises a graticule or reticule.
4. Apparatus as claimed in any one of Claims 1 to 3 adapted for use with a laser designator.



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Application No: GB 9610561.4
Claims searched: 1 to 4

Examiner: Trevor Berry
Date of search: 2 July 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK CI (Ed.O): F3C (CTA)
Int CI (Ed.6): F41G
Other: ONLINE: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	US 5410815 Cubic Defense Systems	1,3,4
X	US 4168429 US Army Sec.	1 to 4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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